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February 6, 2012

Ref: EPR-N

Michael J. Ryan, Regional Director
Great Plains Regional Office
Bureau of Reclamation
P.O. Box 36900
Billings, Montana 59107-6990

Re: EPA Comments on Windy Gap Firming Project Final Environmental Impact Statement; CEQ # 20110413

Dear Mr. Ryan:

In accordance with the U.S. Environmental Protection Agency's (EPA's) responsibilities under the National Environmental Policy Act (NEPA), 42 U.S.C. Section 4332(2)(C), and Section 309 of the Clean Air Act, 42 U.S.C. Section 7609, EPA has reviewed the U.S. Bureau of Reclamation's (BOR) Final Environmental Impact Statement (FEIS) for the Windy Gap Firming Project (WGFP). The purpose of the proposed firming project is to provide more reliable water deliveries to Colorado's Front Range, and to a lesser degree, West Slope communities and industry from the existing Windy Gap Project. The goal is to increase Windy Gap operational capabilities to deliver a firm annual yield of approximately 30,000 acre-feet (AF) to 14 water providers and users.

The FEIS evaluated five alternatives including the No Action alternative. The proposed project (Alternative 2), which is identified as the BOR's preferred alternative, includes the construction of a 90,000 AF Chimney Hollow Reservoir near Loveland, Colorado. A new pipeline connection to existing Colorado-Big Thompson (C-BT) facilities would be used to convey water to the new reservoir. This would provide the ability to store or preposition C-BT water in the new reservoir. The BOR also developed associated WGFP operational changes in this alternative as part of the proposed mitigation for projected adverse environmental effects.

The EPA has been working with the BOR to address key technical issues identified in our review of the Draft EIS. We participated in workgroups that focused on four main areas of concern: temperature, nutrients, stream morphology and aquatic resources. We appreciate the opportunity through these technical discussions to better understand the project and to work toward an improved impacts analysis and disclosure in the FEIS. As this project moves toward implementation, we offer our continued support in designing monitoring and mitigation plans to assure that adverse impacts are avoided and minimized as much as possible.

In the FEIS, the BOR provided supplementary information from existing sources and developed new modeling in an effort to improve the NEPA documentation presented in the Draft EIS. For example, the BOR developed a new dynamic temperature model to better characterize the potential impacts of the project. Other technical enhancements, such as the inclusion of figures and tables to better illustrate the modeling results and projected cumulative impacts to lakes and reservoirs, are the result of our mutual commitment to work through issues and

arrive at an agreed upon resolution when possible. The agencies did not reach agreement in a number of areas. Where we did reach agreement on how to assess impacts, the result sometimes reduced the underlying resource concern and sometimes highlighted resource impacts and the need for mitigation. With this letter, we outline our remaining concerns with the analyses and conclusions in the FEIS, as well as our recommendations for monitoring, mitigation and management actions to be included in the Record of Decision (ROD) to verify impact projections and to reduce and offset the foreseeable impacts to the environment.

Our FEIS review identified remaining resource concerns in two main areas: 1) water quality concerns with lakes and reservoirs; and 2) aquatic life/stream morphology concerns within the Colorado River Basin. It is our view that there remain issues with the data, methodologies and conclusions presented in the FEIS regarding these resources. Our enclosed Detailed Comments describe instances where analyses or conclusions overstate the quality of current resource conditions and underestimate water quality and resource impacts associated with the proposed project.

Our focus regarding lakes and reservoirs is on water quality issues associated with excess nutrient loads that are impacting waterbodies affected by this project, including Granby Reservoir, Shadow Mountain Reservoir, Grand Lake, Horsetooth Reservoir and Carter Lake. Because most of these waterbodies are currently experiencing water quality problems, the EPA closely examined the analyses that assess baseline conditions and nutrient load projections for the project. Where significant uncertainty remains based on the FEIS conclusions, we offer recommendations for the ROD to assure the project will not cause or exacerbate water quality degradation.

Regarding aquatic life and stream morphology impacts in the Upper Colorado River ecosystem, including the effects of the project on sediment transport and temperature, the EPA is concerned that conclusions in the FEIS are inconsistent with existing data. Our concern is heightened by new information available relevant to the characterization of current conditions and impacts to aquatic life. The EPA offers monitoring and mitigation recommendations for the ROD to better protect these valuable resources.

Following release of the BOR's Record of Decision (ROD) for this project, the U.S. Army Corps of Engineers (Corps) will be reviewing this project for a CWA Section 404 permit decision. The Corps may rely, in part, on the FEIS to meet their compliance obligations under the CWA Section 404(b)(1) Guidelines. In our interest to resolve issues as soon as possible to avoid any delay in the permitting process, the EPA has reviewed the FEIS for compliance with CWA Section 404. While we have summarized most of our comments in this letter, we will provide greater detail regarding our concerns to the Corps as we work with them through the permitting stage of the project.

We hope that our comments on the FEIS will facilitate future dialogue with the BOR to assure that the project avoids unintended impacts through monitoring, mitigation and management. We remain available to work with the BOR to design mitigation and monitoring to meet project goals for avoiding and minimizing impacts. If you have any questions regarding our comments, please contact me at (303) 312-6776, or you may contact Suzanne

Bohan, NEPA Compliance and Review Program Director at (303) 312-6925, or Bert Garcia, Ecosystems Protection Program Director at (303) 312-6670.

Sincerely,

o/s/b

Martin Hestmark
Acting Assistant Regional Administrator
Office of Ecosystems Protection and Remediation

cc: Tim Carey, U.S. Army Corps of Engineers, Denver Regulatory Office

Encl: EPA's Detailed Comments on the Windy Gap Firming Project FEIS

EPA's Detailed Comments on the Windy Gap Firming Project FEIS

Overarching Concerns with Analyses and Presentation of Impacts

The EPA has concerns with the analyses and the presentation of impacts in the FEIS. We are concerned that these analyses lead the document to overstate the existing condition of many ecosystem components while also underestimating resource impacts associated with the proposed project. In most cases, the FEIS does not utilize data more recent than 2007, the publication date of the DEIS. While a cutoff date had to be established for the analyses, much of the post-2007 data differ from pre-2007 data and are likely to be more representative of current conditions for some waterbodies. Our review cites concerns with the treatment of data, methodologies and statistics.

For example, the EPA is concerned with the use of averaging in the FEIS, and cites examples in the analysis of water quality, fish habitat and channel maintenance flows. In these cases, averaging removes the ability of the analyses to present short-term or peak events. The FEIS frequently uses annual averages to characterize certain water quality parameters (e.g., dissolved oxygen or chlorophyll *a* concentrations) that can vary significantly over short scales of time and space. Annual average values do not allow for the characterization of variability on smaller time scales or capture the magnitude of shorter-term events. For short-term phenomena such as algal blooms, dips in dissolved oxygen or habitat capacity, averaging of data can remove the actual "signal" of a measured event contained within the original data. As a result, events and impacts limiting aquatic life or exceedance of a regulatory threshold could be obscured by the averaging.

We have provided a few examples of each of these issues in the discussion of our resource concerns below. Cumulatively, these concerns impact the baseline from which impacts are measured, as well as uncertainty with the predicted magnitude of project effects. To assist with managing this uncertainty, EPA includes recommended management actions at the end of each topic.

Lakes and Reservoirs - Water Quality Concerns

Impaired 303(d) List Waterbodies Potentially Impacted by Proposed Project

Many of the lakes and reservoirs that will be used to move Windy Gap Firming Project (WGFP) water to the Front Range (*i.e.* Granby Reservoir, Shadow Mountain Reservoir, Grand Lake, Horsetooth Reservoir and Carter Lake) are experiencing water quality problems related to excess nutrient loads. Excess nutrients can trigger algal blooms, decrease water clarity, and decrease dissolved oxygen levels. Depleted oxygen in deep water can mobilize metals such as manganese and mercury. The resulting fish tissue mercury concentrations are a human health and fishery management concern, while increased dissolved manganese can raise pretreatment costs in municipal water supplies.

The FEIS includes improved documentation of the impairment status for major lakes and reservoirs potentially impacted by the project (see Table 3-55, FEIS p. 3-128). Four of the lakes and reservoirs associated with WGFP (Granby Reservoir, Shadow Mountain Reservoir, Carter Lake and Horsetooth Reservoir) are already on

Colorado's Clean Water Act §303(d) List of Impaired Waters ("303(d) List") with impairments either caused by, or exacerbated by, nutrients. Granby Reservoir, Carter Lake and Horsetooth Reservoir are impaired for their aquatic life use due to high levels of methyl mercury found in fish tissue which poses human health concerns. Low dissolved oxygen increases the availability of mercury to the food chain, and WGFP nutrient loads could reduce oxygen concentrations. Granby Reservoir, Shadow Mountain Reservoir, Grand Lake and Horsetooth Reservoir all have exceeded the water quality standard for manganese due to depleted dissolved oxygen, and the project could exacerbate these levels causing increased costs to municipal water suppliers.

Any addition of nutrients to impaired lakes would be expected to worsen the existing conditions. It is therefore important that the assessment of baseline conditions and the projection of nutrient loads caused by the project be accurate, and that the nutrient reductions through mitigation be measurable and conservative. In the comments below, the EPA identifies a number of instances where significant uncertainty remains regarding analyses, results or interpretation. Given the uncertainty involved with projected results, we also offer recommendations to assure adequate resource protection.

Nutrient Neutral Operation

To assure that the project protects these lakes from additional impact, the BOR intends to implement WGFP as a "nutrient neutral" project. The EPA supports nutrient neutral operation as critical to assuring the project will not cause water quality problems or add to existing problems. Because the nutrient neutral concept is vital to avoiding objectionable impacts, we carefully reviewed the analyses in the FEIS on which the concept relies. To achieve nutrient neutral operation, monitoring and mitigation commitments are necessary in the Record of Decision (ROD) to assure that the project contributes no new nutrients (i.e. no added phosphorus and nitrogen) to the lakes involved. The FEIS does not commit to sufficient monitoring or mitigation to assure this result. EPA offers several recommendations below to address this concern.

The EPA's review of the FEIS identified areas of concern when documenting baseline water quality conditions, documenting baseline nutrient loads, modeling nutrient dynamics/effects, and in calculating the benefits of mitigation. We conclude from our review of these analyses - details of which are listed below - that the FEIS likely underestimates the amount of mitigation that will be necessary to assure nutrient neutral operation. The level of uncertainty left by the analyses argues for upgrading the commitment of mitigation beyond the proposed 1:1 ratio, and during project implementation: committing to confirm the baseline via monitoring; monitoring the actual project loads; monitoring lake water quality; and measuring the effectiveness of mitigation projects.

The following are the EPA's concerns with the ability of FEIS models and analysis to accurately represent current conditions, to reflect nutrient cycling in the system, and to predict project impacts with enough accuracy to assure nutrient neutral mitigation:

Baseline Nutrient Load Conditions: It is important that the baseline from which the mitigation commitments will be measured derive from verifiable data documenting existing conditions. It is our understanding that baseline nutrient loads were developed from a small data set of measured nutrient concentrations at various input locations (that may not be representative) and on modeled hydrology. Because of deficiencies (detailed below) in both the methods used to calculate existing and projected loading, and in modeling procedures for

nutrient fate and transport, nutrient neutral operation of the project cannot be ensured until the baseline nutrient loading rates can be confirmed through monitoring as the project moves forward.

Three Lakes and CB-T System Modeling and Assessment: The FEIS includes analysis of the Three Lakes System (Grand Lake, Granby Reservoir and Shadow Mountain Reservoir) using a dynamic model capable of simulating thermally stratified 3-layer lakes for evaluating projected impacts to the Three Lakes System. The FEIS predicts impacts to Carter Lake and Horsetooth Reservoir using annual outputs from the steady-state BATHTUB model. Due to problems identified below with some model inputs, model assumptions, and with the capabilities of the models themselves, the model results provide less than the necessary level of certainty as to how these lakes process and respond to nutrient inputs.

The FEIS and supporting technical reports do not identify the data used to establish baseline nutrient conditions or for loading calculations. For the tables comparing existing conditions to water quality standards (e.g. Table 3-40) the FEIS does not explain how the analyses establish thermal stratification, and how the presented results are calculated. Data used to represent baseline conditions in some cases appear to exclude certain hypolimnion and metalimnion data that were representative of current impaired conditions. For example, the limited dataset used to characterize existing conditions for dissolved oxygen in Shadow Mountain Reservoir appears not to have used available datapoints indicative of impairment (Table 3-42 compared to Table 3-55 and Lake and Reservoir Water Quality Technical Report Appendix A-3.). Despite Shadow Mountain Reservoir being listed as impaired for aquatic life due to low dissolved oxygen, the table of existing conditions does not include any data exceeding the dissolved oxygen criteria, yet more recent data indicating impairment of the dissolved oxygen criteria are not discussed. Further, it does not appear that the City of Fort Collins' Horsetooth Reservoir data were used in these comparisons or as model inputs. The Horsetooth Reservoir data used was from a timeframe immediately following drawing down and refilling the Reservoir for repairs. This is not considered to be representative of the typical long-term conditions. These omissions would appear to prevent the model and analyses from accurately reflecting current conditions.

The FEIS includes useful figures (3-66 and 3-67) showing the fate and transport of nutrients in the Three Lakes Model. These figures, which show changes in nutrient outflows, internal loading and settling, are not fully explained in the text of the FEIS. The increased nutrient storage in sediments associated with WGFP, is important and is not discussed as a project impact. Compared to existing conditions, the proposed action is predicted to "sink" additional nutrients to settling in lake sediments which could result in undisclosed adverse consequences because these sediments will become a long-term source of excess nutrients to the lakes (see Figure 3-66). The FEIS discussion focuses on changes in average annual nutrient concentrations, but does not discuss sequestration of nutrients in sediments, exports of higher nutrient concentrations through the C-BT system, and their fate over time. These issues likely result in understating lake and river nutrient concentrations, and therefore underestimating WGFP loads.

Further, determining and tracking thermal stratification in lakes is a dynamic process that requires detailed temperature profile data in order to properly and accurately calculate results. There is no documentation that this was done for the comparisons of ambient conditions to water quality standards. It appears that the FEIS calculations and modeling chose a thermocline depth for each lake and assumed that thermocline depth remained constant throughout the summer season in the analyses. This assumption is likely an

oversimplification of these dynamic systems that may have led to removing some data from consideration and analyses, increasing the uncertainty of reported existing conditions and predicted results.

The model results are in some cases inappropriately averaged over an entire year, in effect washing out the events that may represent project impacts and impairment. The FEIS frequently uses annual averages to characterize certain water quality parameters (e.g., dissolved oxygen or chlorophyll *a* concentrations) that can vary significantly over short scales of time and space. Providing an annual average value of these parameters does not allow for the characterization of variability on smaller time scales or capture the magnitude of shorter-term events. Consequently, limited inference can be drawn about the potential impacts to parameters that vary over small time scales or for shorter-term events, particularly from the BATHTUB model results. For short-term phenomena such as algal blooms or dips in dissolved oxygen, averaging can remove the actual "signal" of a measured event, obscuring a significant message contained within the original data (e.g., see TSI calculation based on 6-month to 1-year averages of average daily chlorophyll *a* values p. 3-138, par. 1). Further, the BATHTUB model is not capable of predicting dissolved oxygen concentrations throughout the water column. Instead dissolved oxygen levels were indirectly interpolated from other model results, without a clear translator, increasing uncertainty in the output for Carter and Horsetooth Reservoirs.

While even the best modeled results include inherent uncertainty, the issues identified through our review of the FEIS add significant uncertainty regarding the effect of diversions on nutrient transport, stream and reservoir nutrient dynamics and cycling, and nutrient-related water quality changes throughout the water column. As a result, we believe there is significant uncertainty in the load predictions from WGFP on which mitigation commitments will be predicated. The EPA strongly recommends a management framework involving monitoring and mitigation as a necessary component of the BOR's ROD to assist in assuring and documenting the project's nutrient neutral water quality goals.

Recommendations for inclusion in the ROD:

To assure the project will not cause water quality impacts or exacerbate existing water quality impairment through nutrient neutral operation, the EPA recommends the ROD include the following requirements:

- Verify that baseline loading estimates are accurate through monitoring of the nutrient sources identified in Table 3-68. The monitoring of nutrient concentrations and flows at these sites should be performed for at least two years and at a frequency necessary to verify the predicted loads. Existing data sets for these sources could be used to augment monitoring. All data used should be open to public review;
- Conduct weekly monitoring of nutrient loads from the Windy Gap pumpback and Adams Tunnel flows (i.e. total nitrogen and phosphorus concentrations and flows) during project operations. The loads must be monitored in a way that allows the specific contribution of WGFP loads to be calculated. At least two years of baseline data should be collected prior to WGFP operation, followed by at least ten years of WGFP operation monitoring or until nutrient loading issues are resolved;
- Conduct regular monitoring of Granby Reservoir, Shadow Mountain Reservoir, Grand Lake, Carter Lake and Horsetooth Reservoir for phosphorus, nitrogen, chlorophyll *a,* temperature, and dissolved oxygen through the full depth profile. Include a deep hypolimnion manganese sample with each profile. We recommend monthly profiles from March-May and from fall turnover through ice-up. During the period of lake stratification, approximately June through fall turnover, weekly profiles would be needed

to assess conditions and identify unforeseen impacts. At least two years of baseline data should be collected prior to WGFP operation, followed by at least ten years of WGFP effects monitoring;
- Conduct semi-annual monitoring of fish-tissue mercury concentrations for each of the five lakes and reservoirs listed above; and

To assure that mitigation commitments are providing the predicted load reductions necessary to meet nutrient neutral goals, the ROD should include the following requirements:

- Firm-up specific mitigation commitments and provide initial estimates of the load reduction from each. Because it is likely that the FEIS analysis underestimates WGFP-related loads (for reasons stated above) the projected load reductions should conservatively exceed the estimated loads;
- As mitigation is put in place, monitor and measure the actual nutrient load reductions from each mitigation commitment to assure that all meet or exceed predicted load reductions;
- For nonpoint source mitigation, increase the mitigation ratio to at least 2:1 over the base ratio as appropriate to account for the uncertainty involved in predicting or measuring nonpoint source nutrient reductions, and recognizing that its effectiveness is dependent on diligent long-term maintenance of best management practices.
- Publish an annual monitoring and mitigation evaluation and status report, available to the public, for at least ten years (or longer if the mitigation reductions are not confirmed to be at least equal to the measured project load). This report would document measurements of nutrient loads and lake/reservoir water quality to demonstrate whether "nutrient neutral" mitigation measures are sufficient to offset measured nutrient loading and whether any unforeseen impacts have arisen. It would also document monitoring results associated with each of the implemented mitigation measures and compare against projected nutrient reductions and against the measured nutrient loads; and
- Include *action triggers* in the event that:
    - Monitoring results indicate that WGFP nutrient loading is not fully mitigated, or
    - Monitored lake levels of ambient nutrients, chlorophyll *a* and dissolved oxygen concentrations turn out to be worse than those predicted in the FEIS.

  The triggered action(s) would require increased nutrient mitigation with enough of a buffer to assure Windy Gap operations remain nutrient neutral for the life of the project.

Colorado River Basin - Aquatic Life/Stream Morphology Concerns

The native annual discharge of the upper Colorado River has already been reduced by 67% through historic water diversions according to data in the FEIS (Table 3-1). The changes to natural hydrology, particularly the loss of peak flows, have adversely affected many of the river's functions. Despite these impacts, the river still supports a trout fishery and other recreational and aquatic life uses and values. Yet the river is showing signs of stress. Summer water temperatures are reaching and exceeding state water quality standards for protecting aquatic life. Sediment is accumulating in some reaches, and stream channel morphology is not fully supporting historic functions. As a result, fish and macroinvertebrate populations have significantly declined in some stream segments. All of these indicators raise concern that additional withdrawals from the system will exacerbate the current stressors and the incremental additional withdrawals from the proposed project could lead to disproportionate effects.

The FEIS includes useful additional information and analyses regarding these resources. In comments below we detail remaining concerns with the representation of current conditions in the FEIS with respect to stream morphology and aquatic life. We also express concerns with the FEIS's representation of the effects from WGFP to those resources. Combined, these comments argue for enhanced monitoring and mitigation commitments in the ROD to assure the project avoids and minimizes adverse effects to the river and aquatic life.

Stream Morphology – Peak Flow Events and River Function

EPA has several concerns with the methods used to represent current conditions and project effects related to stream morphology. Peak flow events are key to maintaining natural stream morphology, and they provide and sustain critical river functions including sediment transport and maintaining pore spaces in larger substrates (*e.g.* gravels, cobbles, and boulders) that are key to aquatic life functions. Cumulatively, the issues listed below increase our concern that the project as proposed will exacerbate already degraded river conditions.

The additional analyses of the peak flows needed for channel maintenance indicate that some important peak flow events will occur in 44-54% fewer years under the proposed action compared with existing conditions below Windy Gap Diversion (WGD). This represents a relatively significant change considering the naturally low frequency of these events (see Table 3-32). Similar declines in the frequency of these flows will occur under the cumulative effects scenario as well (Table 3-35). The FEIS flow duration curve analysis also projects that WGFP will exacerbate the loss of high flow events (e.g., flows of 3,160 cfs and higher) in the upper Colorado River system in Grand County. These high magnitude flow events provide numerous ecological functions including partial and full bedload transport, opening interstitial spaces, break-up of channel armoring, periphyton scour/disturbance and limitation of vegetation encroachment. Because WGFP will reduce peak flow events and overall stream discharge compared to existing conditions, this project will exacerbate the effects cited above unless mitigation is included.

The FEIS, in several sections, appears to state conclusions based on analyses or interpretation of results using methods that are inconsistent with scientific protocol. For example, the way the channel maintenance flows analysis is presented substantially understates the potential changes associated with the proposed action. Flow recurrence is projected to decrease from 13% to 6% of the years for flows between 4,600 cfs and 6,520 cfs, which means they will occur 54% less frequently. However, the FEIS states that "flows in the 10 – 25 year recurrence interval would occur about 7 percent less under the action alternatives compared to existing conditions (FEIS 3-97)." This same issue occurs in Section 3.7.3 on Cumulative Effects (p. 3-103). Reducing the frequency of these flow events by 54% is a substantial change, especially given the naturally low frequency of these high flow events, and the proposed mitigation is unlikely to prevent adverse impacts associated with loss of channel maintenance flows.

In an example from the stream morphology section, analyses were conducted using gauge data from Hot Sulphur Springs and Kremmling (more than 8 miles downstream of Windy Gap Diversion), but available U.S. Geological Survey (USGS) Windy Gap gauge data – a site much closer to the location of additional withdrawals – were not included in the analyses. Although flow data may be similar for these two gauges, observations of stream morphology and aquatic life indicate the FEIS study locations may not be representative

of the reach immediately below the diversion. Furthermore, the FEIS maintains that the 1981study by Ward and Eckhart is representative of the current geomorphic conditions in the Colorado River below WGD following construction and operation of the original Windy Gap project, but does not provide any current data from this reach to support this assertion. The effects of the WGD are most likely to be seen in the reach immediately below WGD and before the influence of tributary streams are added. Despite two recent reports from Colorado Division of Wildlife (DOW) (Nehring, *et. al.* 2010 and Nehring, *et. al.* 2011) that cite stream morphology degradation in the reach below the WGD structure that will likely be exacerbated by the proposed project, the FEIS concludes, "The upper Colorado River is a morphologically stable stream and the changes in flow predicted from the WGFP are not expected to substantially affect stream morphology or sediment transport and deposition in the Colorado River below Windy Gap Reservoir (p. ES-13)." In this case, the proposed mitigation for stream morphology is not designed to remedy the existing impacts or to avoid exacerbating those impacts.

In order to determine whether the proposed peak flows will be sufficient to support sediment transport functions, the FEIS includes additional data from the Breeze station to evaluate the streamflow needed to mobilize sediments (i.e., shear stress) ranging in size from fine sediments to coarse gravel. It would be advisable to also consider the relationship between streamflow and larger sediments, including cobbles and boulders, as previously recommended by the EPA. These larger sized sediments, when mobilized, do a considerable amount of work on the channel, including creation of riffle and pool complexes, abrasion of periphyton and full bedload transport. Without an analysis of the shear stress and streamflow magnitude needed to move larger substrates, it is difficult to conclude, as the FEIS has, that peak flows associated with the proposed project will be sufficient to assure similar channel maintenance functions normally carried out by large sediments classes in high flow. It is likely that the flow magnitudes necessary to mobilize these larger sediment classes fall within the range of channel maintenance flows that will be most impacted by the proposed project (i.e., the 5-50 year flow events).

Consistent with our comments on the DEIS, and for the reasons stated above, EPA also remains concerned that the proposed flushing flow mitigation is limited to the release of 600 cfs for 50 consecutive hours at least every three years, and only under certain conditions (p. E-14). The FEIS states that flows of 850 cfs or higher are necessary to mobilize large gravels, and that flow magnitudes associated with a 50 year flood event are necessary for full bedload transport. As we have explained throughout our technical discussions, we do not think that flushing flows of 600-850 cfs are sufficient to maintain the channel and preserve ecological characteristics of the river. According to Nehring et al. (2011), the loss of aquatic taxa in the reach immediately below WGD is likely due to reductions in magnitude and duration of scouring flushing flows. Nehring et al. (2011) states that "periodic flushing flows of sufficient magnitude and duration are critically important for maintaining the biotic integrity of stream ecosystems…[A] true flushing flow requires a discharge substantially greater than 1,000 ft3/s for several weeks, as occurred in 2010 and 2011. Flows of lower magnitude and shorter duration will not result in the deep cleaning of the cobble-boulder substrates in the riffles, chutes or pools" (p. 81).

In the FEIS mitigation plan, bypassing a 600 cfs flushing flow once every three years would only be required in years when natural flows are available and when the Subdistrict has over 60,000 acre-feet of water supply in Chimney Hollow and Granby Reservoirs on a specific day, April 1. By making these important flushing flows a conditional requirement, the likelihood that mitigation flows will be provided at the needed frequency is reduced, particularly in drier weather cycles when those flows are especially important. Additionally, as

indicated in the FEIS, WGFP water could be stored in reservoirs other than Granby and Chimney Hollow to allow for operational flexibility in the C-BT system. Because WGFP water can be stored in other C-BT reservoirs to meet customer needs, there is no assurance that mitigation commitments contingent upon levels in Chimney Hollow and Granby would occur at the frequency needed to provide the desired result.

An analysis of impacts for stream hydrology, morphology and other resource areas is absent for the reach of the Colorado River immediately below Granby Reservoir. In the FEIS, the reach of the Colorado River between Granby Reservoir and Windy Gap Diversion is divided into two reaches for analysis, one being located upstream of the Fraser River confluence and the other downstream of the Fraser River confluence and only the reach downstream of the Fraser River confluence is analyzed in detail in the FEIS. The reach immediately below Granby Reservoir was not analyzed in detail despite the fact that annual flow depletions of 15% are predicted for this reach in an average year. Because annual flow depletions in this reach are similar to those below the Windy Gap diversion, it is possible that similar stream morphology and aquatic life impacts may occur in this reach and appropriate mitigation needs to be provided.

Recommended Mitigation for Hydrology-Related Effects

EPA recommends the ROD include the following as mitigation requirements:

- We continue to recommend that additional flushing flows of bankfull (1240 cfs) and higher below WGD should be incorporated as mitigation for this proposed project. It is likely that flows in the 5-50 year recurrence interval range provide numerous ecological functions, including bedload transport, break-up of channel armoring, periphyton scour/disturbance and limitation of vegetation encroachment, and as such, flushing flows of this magnitude should be proposed at sufficient duration and frequency to maintain this reach of river.
- Any mitigation proposed to offset impacts to the upper Colorado River system should not be linked to storage levels or operations of reservoirs, but instead should be based solely on the magnitude of impact to Colorado River resources. EPA recommends that the reservoir storage condition be removed from the flow mitigation.
- EPA recommends an added mitigation measure to provide assurance that Windy Gap Reservoir maintenance (*e.g.* dredging) efforts will not contribute sediment loads to the Colorado River during periods of low flow, when the River has insufficient power to transport that sediment.
- EPA recommends that mitigation to offset impacts to stream morphology and aquatic life, including possible reduced habitat availability, be proposed for the reach of the Colorado River immediately below Granby Reservoir.

Surface Water Quality – Temperature

The FEIS includes significantly improved dynamic temperature modeling that more accurately predicts the effects of WGFP alternatives on river temperatures. This model has added certainty and reduced some of the EPA's concerns with the river temperature analyses. Windy Gap Reservoir is a shallow, in-channel impoundment that already contributes significantly to warming the river below. The FEIS acknowledges that additional water withdrawals and the resulting lower flows can exacerbate the high temperature events. Additionally, while the FEIS does not model the potential exacerbating effects of climate change, it does

recognize that climate change will likely increase river temperatures on average over time as the air becomes warmer. These factors heighten the importance that WGD be operated to avoid contributing to temperature effects on aquatic life. In this section we detail the EPA's remaining concerns with temperature analysis and the proposed mitigation, and recommend monitoring and mitigation enhancements to avoid contributing to exceedance of Colorado's acute, chronic or narrative temperature water quality standards (WQS) in the river downstream of WGD.

Narrative Temperature Standard: In addition to chronic and acute temperature standards, Colorado has published a narrative temperature standard that applies to effects that may occur with temperatures below the chronic threshold. The FEIS states "Water temperatures lower than the MWAT [mean weekly average temperature: chronic standard] would not adversely impact the species" (FEIS, pg. 3-226). The FEIS analysis is incomplete in its evaluation of the potential impact of an elevated water temperature profile on resident aquatic life because it does not consider potential thermal impacts below those acute and chronic thresholds as required under the narrative portion of the Colorado's water temperature standard. The analysis also neglects to evaluate the significance of the *magnitude* of modeled increases in water temperatures during cooler water temperature months, such as June. The temperature modeling assessment in the FEIS does not discuss or quantify temperature increases that would occur in June as a result of the project, a month when significant volumes of water are planned to be diverted as a result of the WGFP. In the Colorado River, significant increases in June water temperatures could disproportionately impact priority restoration species such as the rainbow trout, a fish which has these thermally-sensitive life stages present during this month (Ewert 2010; Nehring 1988). The FEIS does not evaluate whether the WGD could adversely affect trout due to project-related June temperature increases and therefore does not assure compliance with Colorado's narrative WQS.

Proposed Temperature Mitigation: There are several unsubstantiated differences between the proposed mitigation provisions in response to approaching the chronic temperature WQS versus the acute WQS. In the case of the chronic WQS, the FEIS states that when the weekly average temperature (WAT) exceeds the MWAT Chronic Threshold, the Subdistrict will reduce or curtail WGFP pumping at the WGD to the extent necessary to maintain temperatures within the MWAT Threshold. The mitigation provision for the chronic WQS is only triggered after the standard is exceeded whereas, a safety factor is added as a buffer, triggering mitigation related to the acute WQS. The chronic WQS, like the acute WQS warrants a trigger that is below the actual standard value such that mitigation provisions would contribute to preventing exceedances of the WQSs.

Additionally, the mitigation provision for the acute standard includes potential reduction or curtailment of pumping for both the original Windy Gap Project *and* the WGFP, whereas the mitigation provision for the chronic WQS considers only reduction or curtailment of WGFP pumping. The option to curtail or reduce pumping should include pumping from both the original Windy Gap Project and WGFP in either the acute or chronic scenario as both are equally important.

Temperature Mitigation and Monitoring Recommendations:

EPA recommends the ROD include the following requirements:

- Apply equivalent temperature mitigation for both the acute and chronic scenarios regarding curtailment or reduction of pumping with at least the proposed 1°C safety factor, including commitments from Windy Gap and WGFP withdrawals.
- Commit to at least two years of baseline monitoring of June temperatures and their effects on thermally-sensitive life stages of rainbow trout to evaluate compliance with the narrative WQS. Monitoring should then be continued for at least two years after WGFP is operational to compare against the baseline. If effects triggering the narrative temperature WQS are found, appropriate management actions should be committed to, including curtailment or reduction of pumping.
- Place an additional continuous temperature gauge in the reach upstream of the influence of WG Reservoir. Combined with the two proposed continuous temperature gauges downstream of WGD, this gauge would be useful in determining the relationship between Windy Gap Project or WGFP operations and any exceedance of temperature standards.

Aquatic Resources – Aquatic Life

The FEIS characterization of aquatic life impacts is substantially limited because it does not include data within the first 8 miles downstream of WGD, the reach most likely to experience adverse effects. The Colorado DOW and other entities have collected macroinvertebrate and fish data from the reach immediately downstream of the diversion, although these data were not included the FEIS. Specifically, the FEIS acknowledges that additional data regarding the condition of the invertebrate community exist (*e.g.* Nehring et al. 2010) although it does not explore this information in any depth as it pertains to conclusions regarding the condition of the river. The most recent DOW report (Nehring et al. 2011) provides a more comprehensive assessment of the current condition of the aquatic community in the Colorado River both upstream and downstream of the WGD, and directly fills the information gap for this reach. The DOW study includes aquatic resource sampling sites 1.5 and 3 miles downstream of WGD providing new and valuable information to inform the forthcoming BOR decision on WGFP and its associated mitigation requirements.

Based upon new data released in the DOW Report (Nehring et al. 2011), significant effects of the original Windy Gap project may be occurring within the first few miles downstream of the diversion and the proposed project is likely to exacerbate these effects. The DOW report documents significant declines in mayfly, stonefly and caddisfly taxa (reduced by 54%, 40% and 62%, respectively) between 1981 and 2010 at sites downstream of the diversion, and the local extirpation of a native fish (mottled sculpin), and attributes these declines to current water withdrawals in the system and the related effects on channel functions. DOW also documents development of sediment beds and associated mats of rooted aquatic vegetation below WGD. In explaining the biotic condition, DOW concludes that "chronic sedimentation and clogging of the interstitial spaces in the cobble-rubble dominated riffles areas of the upper Colorado River below WGD is the overarching problem that has increasingly compromised the biotic integrity and proper function of the river over the past 25 years. The proposed firming projects at Windy Gap and the Moffat Tunnel are only going to further exacerbate this situation." The DOW report also notes, "The severe reductions in the frequency, magnitude and duration of high flushing flows below WGD since its construction in the 1980s, has severely reduced the stream power in

the Colorado River downstream of Windy Gap." The DOW report cites six stream ecosystem issues associated with water storage and export, including 1) restoration of channel connectivity, 2) channel reconfiguration, stream power and flushing flows, 3) sediment deposition and transport, 4) water temperature, 5) encroachment of rooted aquatic vegetation, and 6) whirling disease. The EPA agrees with this list, and recommends that the information in this report be used to inform the characterization of current conditions and predicted impacts and that mitigation be proposed to offset the incremental effects of this project that relate to these issues.

EPA appreciates the inclusion of additional macroinvertebrate metrics, including % EPT taxa (Ephemeroptera, Plecoptera and Trichoptera) and the Colorado Multi Metric Index tool (MMI), however the EPA is concerned that they were incorrectly used to conclude that the current aquatic condition is "excellent," and that no additional impacts are likely to occur from the proposed project (p. 3-208). According to Nehring et al. (2011), the species assemblage consisted of 73% EPT taxa prior to the construction of the Windy Gap dam, compared with 56% EPT taxa in 2010. These declines in characteristic montane taxa in response to water withdrawals and their associated stressors can inform an assessment of current conditions and direct project impacts, because they indicate that the current community is already impacted by water withdrawals and similar future withdrawals, as proposed in this project, will add to these stressors. As such, a community consisting of 56% EPT taxa as cited in the FEIS likely reflects compromised biotic integrity and function, and not an excellent condition. Nehring et al. (2011) concluded that withdrawals anticipated from the future Windy Gap and Moffat diversions would exacerbate these declines and similar trends in taxa loss may be expected following the proposed project..

Further, to characterize health of the benthic macroinvertebrate community of the Colorado River below WGD, the FEIS summarizes macroinvertebrate data collected in two studies (FEIS pg. 3-208) (Rees 2009; Miller Ecological Consultants 2010). The FEIS correctly defines the MMI as a unitless index that assesses biological condition on a scale of 0-100, and correctly identifies attainment and impairment thresholds for high-elevation cold-water streams (50 and 42, respectively). The FEIS then presents scores from the Rees (MMI values of 92 and 89 for samples taken above and below Windy Gap) and Miller Ecological Consultants studies (MMI values of 100 at Lone Buck and Breeze sites below Windy Gap) as evidence of a "healthy macroinvertebrate community" (FEIS pg. 3-208). The FEIS concludes that "these MMI values indicate the existing macroinvertebrate community is unimpaired" (FEIS, pg. 3-229). These high MMI scores are very different than those presented as evidence during a December 2011 Colorado 303(d) rulemaking hearing for this portion of the Colorado River. Macroinvertebrate data from the Colorado River below Windy Gap was presented from several participants in the hearing, including the Northern Colorado Water Conservancy District (NCWCD), citing much lower MMI scores (37-60) than reported in the FEIS. For example, a memo by Timberline Aquatics (Rees 2009) presented data from an October 2008 assessment of the benthic macroinvertebrate community downstream from Windy Gap Reservoir, and the resultant MMI score of 44.6 differs significantly from the MMI value of 89 reported in the FEIS (also Rees 2009). It is not immediately apparent if these MMI scores were calculated from the same macroinvertebrate sample in different ways, however, there is a large discrepancy in MMI values.

Given the conflict with MMI scores presented in testimony surrounding the § 303(d) list hearing, the conclusion reached in the FEIS regarding the health of the existing macroinvertebrate community below WGD should be reevaluated. The scores presented in testimony are in much closer proximity to non-attainment and impairment thresholds, and as such, any incremental degradation of the macroinvertebrate community is problematic and

could lead to aquatic life impairment. Importantly, as a result of the same 303(d) hearing, a portion of segment COUCUC03 (Colorado River from below Windy Gap Reservoir to FR538) was placed on Colorado's Monitoring and Evaluation list, a list which "identifies water bodies where there is reason to suspect water quality problems, but there is also uncertainty regarding one or more factors, such as the representative nature of the data" (CDPHE Water Quality Control Commission, 5-CCR-1002-93).

EPA is concerned that daily habitat data were used for aquatic habitat modeling (p. 3-215), but were averaged together into two-week means for presentation in the FEIS. A daily time-step is appropriate to determine habitat availability. Presenting these data as a two-week average removes the daily variations which can be limiting for aquatic life, and the full magnitude of predicted effects would be potentially masked.

Although the FEIS acknowledges that WGFP will further reduce peak flows in the Colorado River in Grand County, and will have adverse impacts to aquatic life including reduction in trout habitat in the Colorado River, it does not include mitigation sufficient to offset these effects. Similarly, no mitigation is proposed for similar reductions in trout habitat in Willow Creek.

Aquatic Life Mitigation Recommendations

EPA recommends the BOR include the following mitigation measures that were identified in the DOW's 2011 report, as requirements in the ROD:

- Construct a bypass channel around Windy Gap Dam. The bypass channel would reduce or eliminate high temperature events exacerbated by WGFP that stress trout populations, reduce sediment deposition and transport impacts to the river exacerbated by WGFP, restore river connectivity for many aquatic species, and reduce whirling disease impacts to fish populations. The bypass channel would mitigate some of the likely impacts on aquatic life below the diversion associated with WGFP operation, potentially even improving some conditions over the current condition.
- Commit to in-stream channel reconfiguration for the Colorado River below WGD to mitigate for the aquatic life effects of lower discharge associated with WGFP. Channel reconfiguration would reduce the loss of habitat availability for fish and macroinvertebrate populations downstream and increase stream power to clear fine sediments.
- Commit to additional channel maintenance flow requirements of sufficient magnitude, duration and frequency to maintain the ecological functions in the river to address the loss of high flow events due to WGFP withdrawals.